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ABSTRACT

Various topics on water and water conservation are discussed, each general topic followed by a student activity. Topics include: (1) importance of water; (2) water in the environment; (3) getting water to and from homes (making water usable; treating wastewater; on-site systems, including water wells and septic tanks); (4) relationship between water and energy; (5) water conservation in homes, focusing on the nature and operation of toilets; (6) conservation of water when showering/bathing; (7) ways to save water inside and outside homes; and (8) nature and operation of water meters; a final activity focusing on collecting water/water conservation articles from newspapers is provided. Illustrations accompany discussions and activities. (JN)

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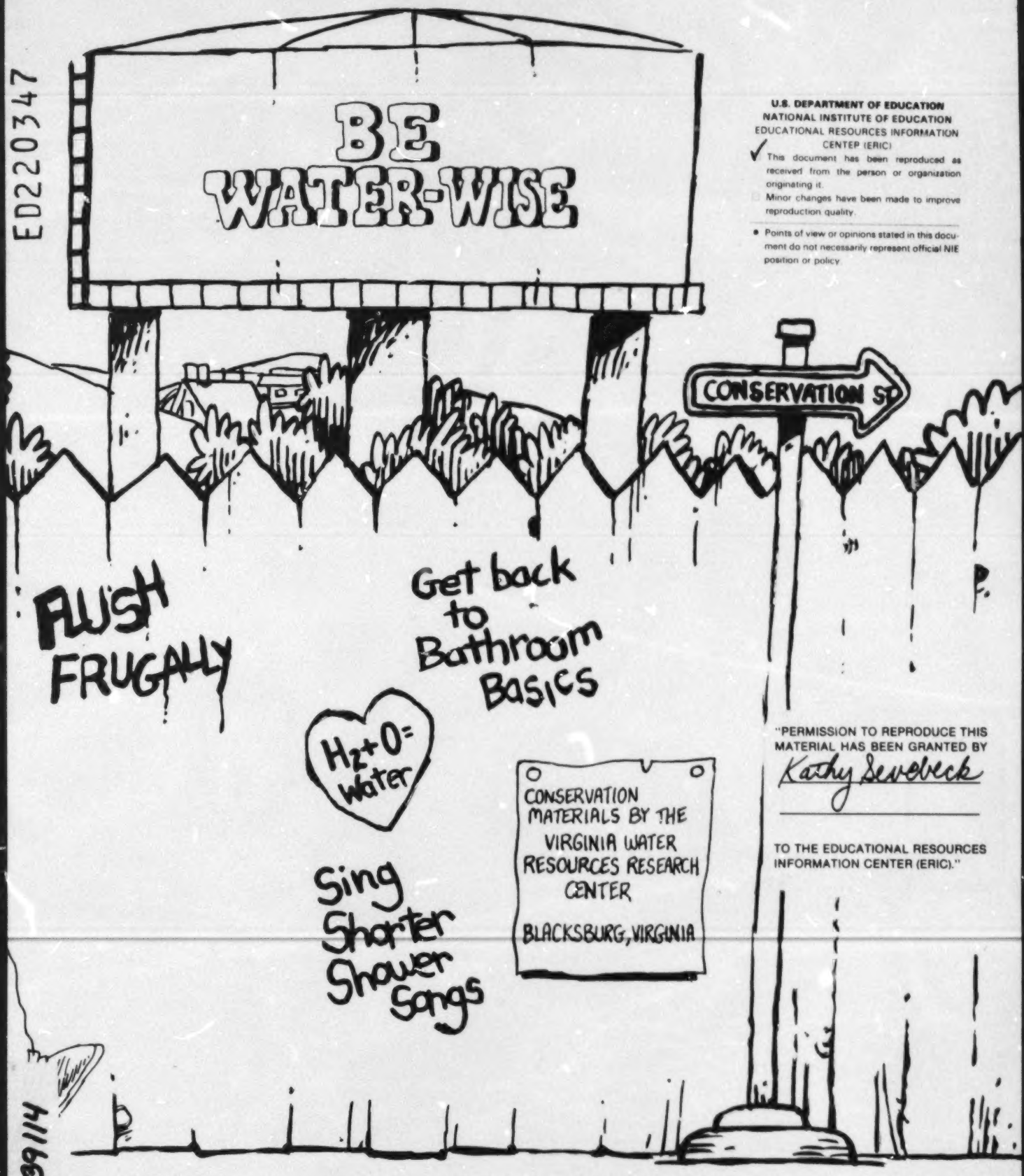

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Table of Contents

Chapter		Page
1.	The Importance of Water	1
2.	Water in the Environment	5
3.	Setting Water To and From Our Homes	9
	Making Water Usable	9
	Treating Wastewater	11
	On-Site Systems	14
	Water Wells	14
	Septic Tanks	15
4.	The Relationship Between Water and Energy	19
	Water and Energy	19
	The "Neater" Heater	21
5.	Water Conservation in Our Homes	26
	Toilet Training	26
	More Bathroom Basics	34
	All Around the House	37
	Indoors	37
	Outdoors	39
	Meet Your Meter	41

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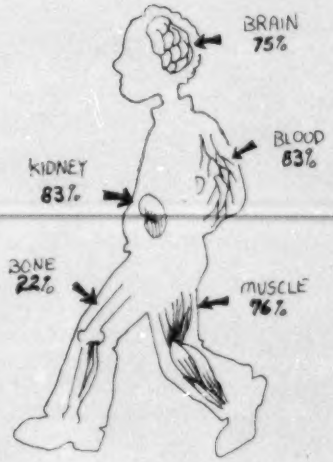
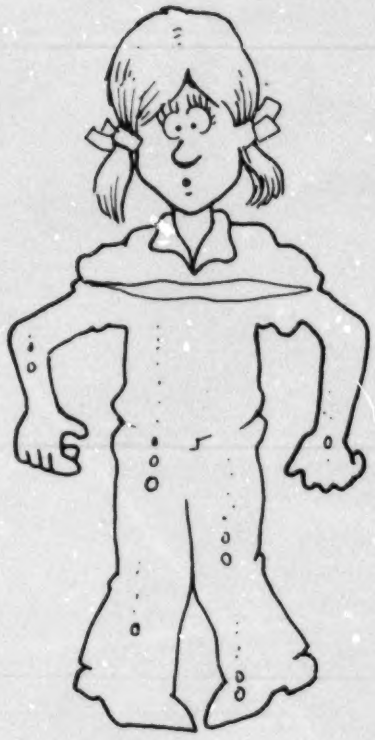
Funds for the development of this conservation booklet were provided to the Virginia Water Resources Research Center, in part, by the Office of Water Research and Technology, U.S. Department of the Interior; the Virginia Division of the Izaak Walton League of America; and the Virginia Commission of Game and Inland Fisheries.

THE IMPORTANCE OF WATER

Your body needs about 2 quarts of water every day to be healthy. You get some of that water from the food you eat. An apple is about 80 percent water, a loaf of bread is about 35 percent water, and a ripe tomato is about 95 percent water.



The tissues and organs of your body contain a large amount of water. This amount varies from person to person and even from one part of your body to another. About 65 percent, or 2/3, of your body weight is water. The brain, for example, is 75 percent water, blood is 83 percent, and "dry" bones are 22 percent.



Here's how you can figure out about how much water you have in your body.

Multiply your weight by 2. Then divide by 3. The answer will give you the number of pounds of water your body contains.

Since a quart of water weighs about 2 pounds, divide your last answer by 2 to get the amount in quarts. For example, if you weigh 90 pounds, your body contains 60 pounds of water or 30 quarts (7-1/2 gallons).

YOU MUST HAVE WATER TO LIVE. There are no substitutes. You may be able to live without food for more than two months, but you would probably die in less than a week if you had no water.

Your body needs a large amount of water because the water helps:

- digest your food,
- cool your body,
- lubricate your joints and keep tissues soft,
- remove your body wastes, and
- clean your eyes.

WATER IS ALSO IMPORTANT TO THE WAY YOU LIVE. Every day in the United States, about 355 billion gallons of water are used. That's almost 2,000 gallons for each person in the country every day. Most of this water is used for industry (making products and producing energy) and agriculture (growing food).

Water is needed to grow your food because plants and animals must have large amounts of it. A dairy cow has to drink 36 gallons of water to produce 12 gallons of milk. Growing one ear of corn requires 25 gallons of water. Some scientists have figured it takes about 1,400 gallons of water to make a meal containing a hamburger, french fries, and soft drink.

Water is required to manufacture or process almost every product you use, including the paper you're reading, the clothes you're wearing and the chair in which you sit. For example, over 100,000 gallons of water are needed to make an automobile, and 70 gallons are required to process 1 gallon of gasoline.

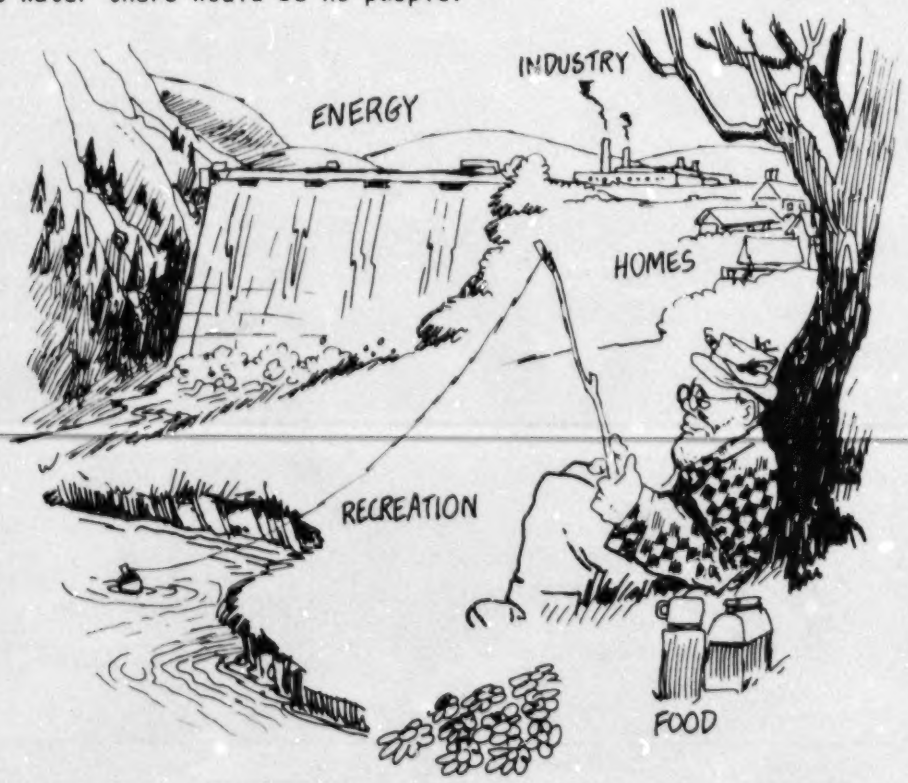
Water allows products to be moved from one place to another on ships and barges.

Water is necessary to clean things in your home, including your body and your clothes. Water also carries from your home waste products that you flush or drain away.

Water may be used to produce electrical energy when it flows over a dam. It is required to mine coal, drill for oil, and provide nuclear power.

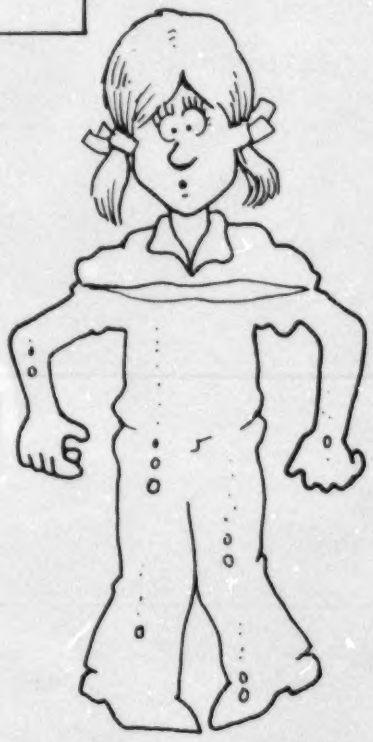
Water provides many kinds of recreation like swimming and fishing.

Without water there would be no rivers, lakes, forests, animals, or plants. Without water there would be no people.



INVESTIGATION 1
THE IMPORTANCE OF WATER

Name_____



1. How many gallons of water are you?

   a. Weigh yourself. _____ pounds

   b. Multiply your weight by 2.

   c. Divide your answer by 3. This answer is the approximate number of pounds of water in your body.

   d. A quart of water weighs about 2 pounds, so divide your last answer by 2.

   e. There are 4 quarts in a gallon, so divide again by 4. Therefore, there are _____ gallons of water in your body.

2. On the back of this worksheet or on a separate sheet of paper, list 20 ways you use water. Underline the 10 uses that are most important to you. Then circle the uses that you couldn't live without.

3. Why do people use more water today per person than was used 50 years ago?

4. Scientists have determined that it takes about 1,400 gallons of water to make a meal of a hamburger, french fries, and a soft drink. List at least four ways that water is used to produce this meal.

   a.

   b.

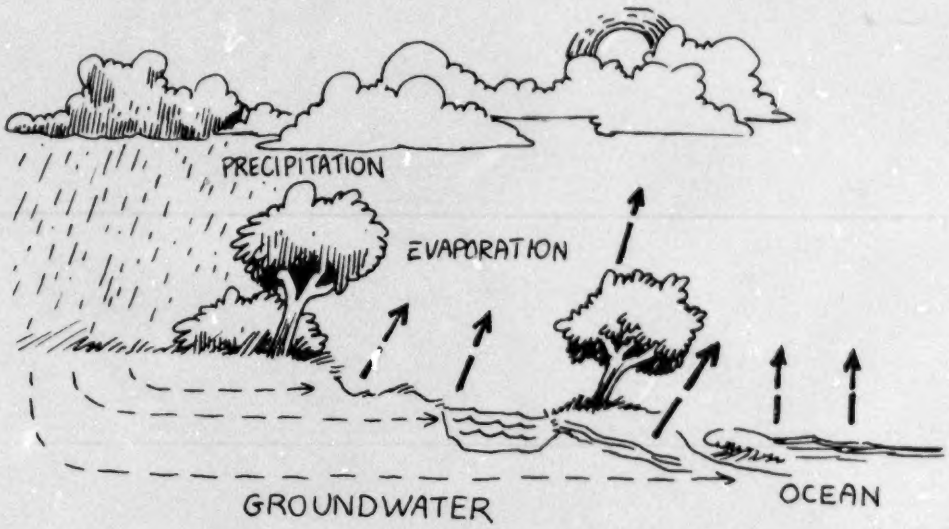
   c.

   d.

WATER IN THE ENVIRONMENT

The sun is the powerful pump that keeps water moving through a circular path called the water cycle or hydrologic cycle. The water in the air falls as precipitation (rain, sleet, hail, or snow) and is replaced by the evaporation of water from the land and oceans. Most of the water that goes into the air as a gas rises from the oceans, which cover 3/4 of the earth, and most of the water falls back into the oceans. Some water falls onto the land where it is used by living things, seeps into the ground, fills lakes, runs into streams and rivers, and evaporates. Most of the water that runs into rivers and streams returns to the oceans in a few weeks. The water that soaks into the ground is called groundwater, which also moves toward the oceans, but very slowly--about 3 feet every year.

The hydrologic cycle doesn't distribute the water evenly around the earth. When water doesn't fall in a certain area and the groundwater level drops, the condition is called a drought. When large amounts of water fall in a short time, the land can't absorb all of it and rivers can't hold it within their banks. Water pours over the land, causing a flood.



The amount of water available for our use (water quantity) depends not only on the water cycle, but also on the condition of the water (water quality). Whether water is polluted and unusable or whether there is no water available, a person needing water has a problem.

Our water supplies can be polluted in several ways.

Sewage--animal, plant and other wastes that are flushed down drains and toilets in homes. Sewage is sometimes called wastewater.

Nutrient chemicals--nitrogen and phosphorus compounds that encourage the growth of plants in the water. When the plants die, the water smells, tastes, and looks bad.

Toxic substances--chemicals such as pesticides (bug killers) and mercury that can make people and animals ill or die.

Sediment--soil that washes into streams and rivers.

Heat--waste heat from factories or electrical generating plants (thermal pollution) that increases the temperature of the water and affects the plants and animals in the water.

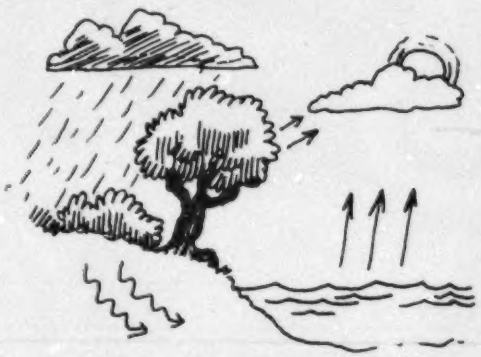
Pollutants come from both point and nonpoint sources. Nonpoint sources are scattered and are located over a wide area. Nonpoint pollution includes sediments, animal wastes, pesticides, and other material that can be carried by water from parking lots, streets, yards, fields, and forests. Not many laws prevent this kind of pollution, but many states have asked people to voluntarily reduce nonpoint pollution. Loggers, for example, are being taught how to build roads that do not cause sediment to wash into streams.

Point source pollution, on the other hand, is waste that generally comes from sewage treatment systems or industries. Problems caused by point source pollution have decreased in recent years because of state and federal laws such as the Clean Water Act of 1977.

The quality of water is important to consider because we use the same water over and over again as it is recycled by nature or by people. We may be drinking water that George Washington used many years ago. About the same quantity of water is available to us today that we had centuries ago and that we will have in the future. That means our water supply is finite or limited. But if we pollute a part of this finite supply, we will not have as much clean water as we have had in the past. Scientists predict that by the year 2000, we will be using as much as three times more water than we use now. We need to start using our available clean water supplies more wisely.

INVESTIGATION 2
WATER IN THE ENVIRONMENT

Name_____



1. Has your community ever experienced a drought?

   _____ NO

   _____ YES When was the last drought?

2. Suppose your town is experiencing a water shortage. You are a member of the town council and the mayor asks you to write an emergency plan to save water. List four rules you might make to help your town save water.

   a.

   b.

   c.

   d.

3. Has your community ever experienced a flood?

   _____ NO _____ YES When was the last flood?

4. What is the average yearly rainfall in your area or community? _____

5. Do you think it is a good idea to water the lawn on a hot, sunny day? Why or why not?

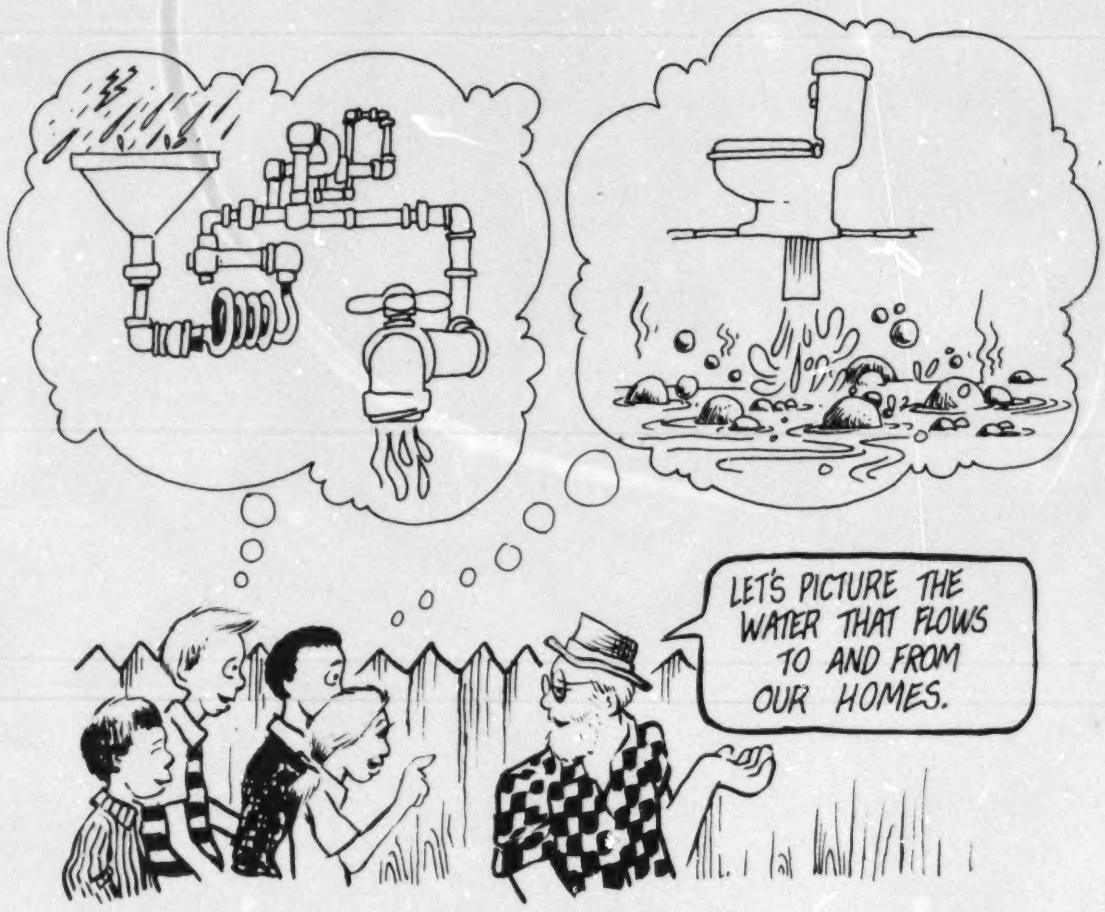
6. Name two nonpoint sources of pollution in your community.

   a.

   b.

7. Has your community experienced any point source pollution problems in the last 10 years?

   _____ NO _____ YES Describe the problems.



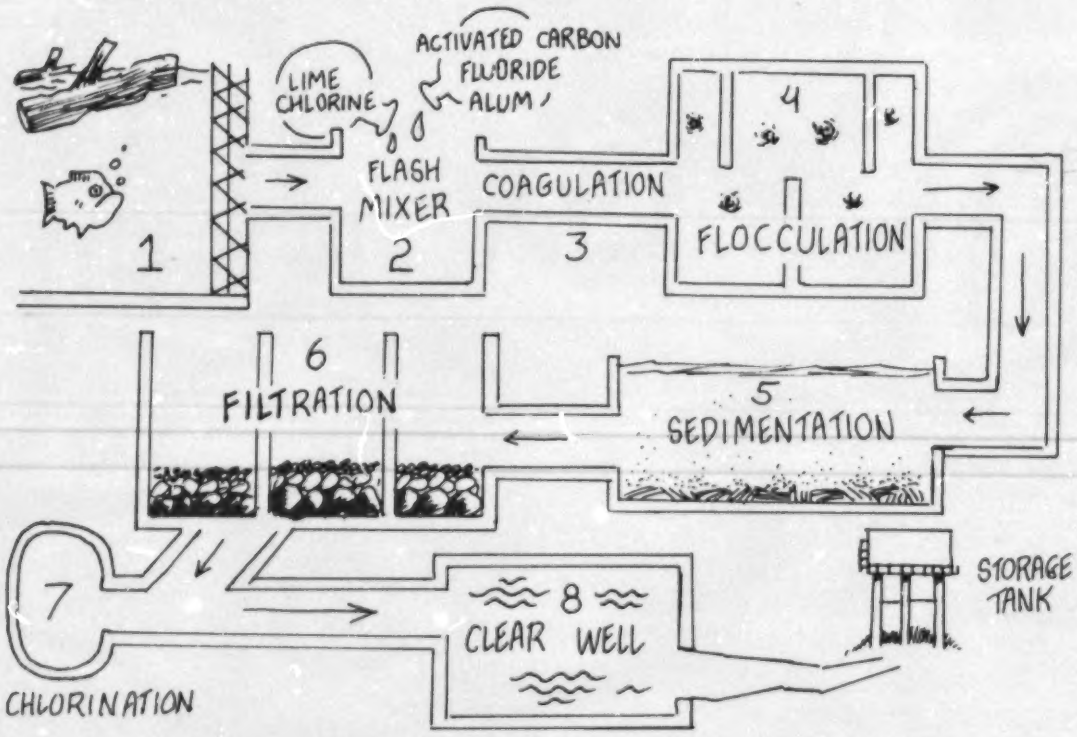
GETTING WATER TO AND FROM OUR HOMES

Making Water Usable

For many uses, such as drinking, citizens need water that is cleaner than that found in rivers and lakes. To clean or purify the water, cities and towns have built treatment systems, which cost money and require energy to run.

Water is pumped from a lake, river, or reservoir into the water filtration plant.

1. First, it is strained to keep fish and large objects out of the system.
2. Chemicals such as alum, chlorine (to kill bacteria), fluoride (to strengthen teeth), and lime (to prevent rust in water pipes) are added to the water at the flash mixer. Activated charcoal may also be added if taste and odor are problems.



3. The alum causes a chemical reaction in water that enables the dirt and other particles to stick together. This reaction is called coagulation.

4. Sticky, fluffy particles called floc are created by the alum and during flocculation, dirt and other particles in the water are attracted to the floc and "clump" together.

5. In the sedimentation basins, the floc sinks to the bottom. This sediment, or solid matter, is called sludge and has to be removed from the plant. The disposal of sludge is a big problem for communities.

6. The clear water above the sediment is filtered through layers of sand and gravel to remove remaining dirt and other impurities (filtration).

7. Chlorine is added to kill any bacteria still remaining in the water (chlorination). Some plants may add fluoride and other chemicals at this stage.

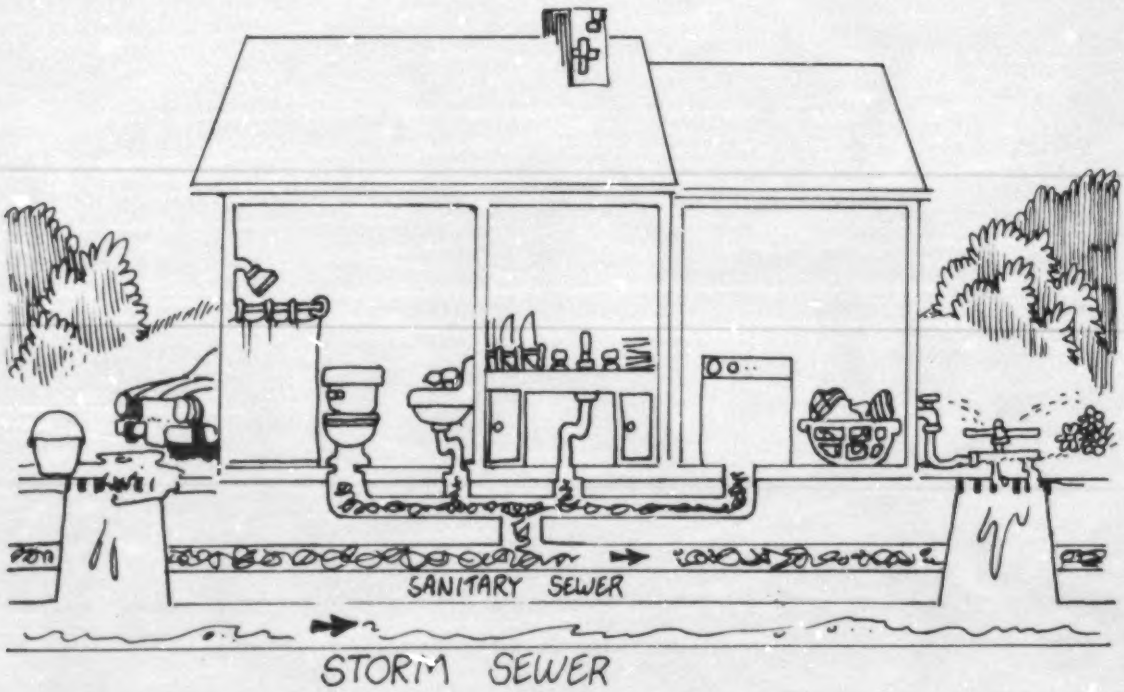
8. The filtered, chlorinated water is stored in clear wells and in storage tanks until it is needed.

One way to remember the treatment process is to learn the "tion" words: coagulation, flocculation, sedimentation, filtration, and chlorination.

After the water has been treated, it's safe for our use. (Water can become polluted in the pipes or storage tanks before it reaches our homes but this doesn't happen too often.) After we've finished using the water in our homes, it flows down drains and toilets as wastewater.

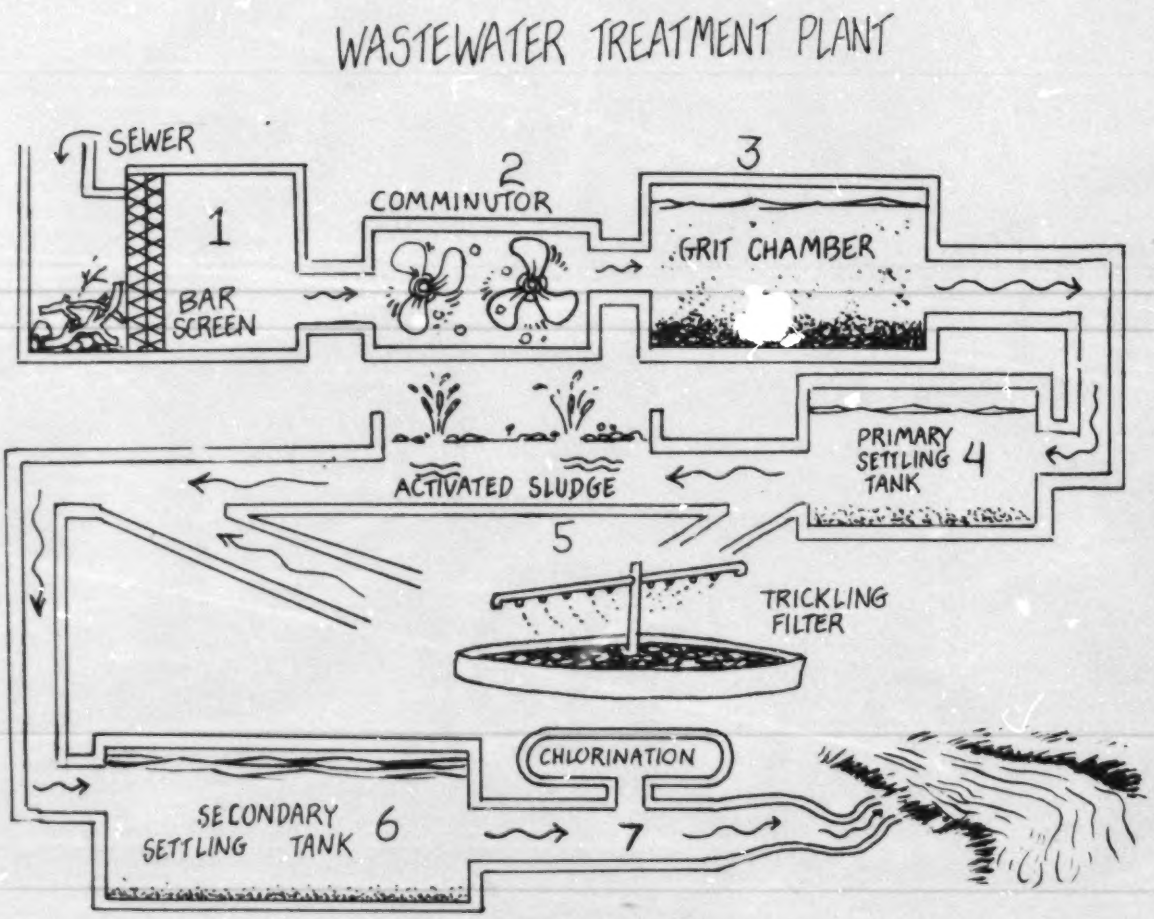
Treating Wastewater

Sanitary sewers carry wastewater from homes and factories to a sewage or wastewater treatment plant. Storm sewers carry water that runs off lawns and streets directly into waterways. This water often contains pollution from nonpoint sources. Combined sewer systems carry all wastes to the treatment plant. A combined sewer system can create problems during periods of heavy rainfall because treatment plants can become overloaded and untreated sewage may be sent to waterways.



Most towns and cities with wastewater treatment plants are generally required by law to have two phases of treatment: primary and secondary. The first phase removes some plant and animal wastes and other particles. The second phase removes more of the pollutants found in wastewater.

Here's how some wastewater treatment plants might work:



1. Sewage and wastewater first flows through a bar screen, which removes large objects that could damage the treatment equipment.
2. The comminutor, like a garbage disposal, then grinds the materials floating in the wastewater into smaller pieces.
3. In the grit chamber, particles like sand and grit settle out and become sludge, which is removed.

4. In the primary settling tank, slow-settling solids sink to the bottom and are removed. These solids usually go to a sludge digester, where bacteria and other microorganisms reduce the size of the sludge. This primary phase of treatment removes about 35 percent of all pollutants.

5. Next the sewage goes through one of two secondary treatment processes: trickling filter or activated sludge, which removes about 85 percent of the remaining pollutants. During the trickling filter process, the wastewater is sprayed over the top of the filter by arms that rotate like a lawn sprinkler. The wastewater then trickles down through a bed of rock and gravel, which is covered with a layer of bacteria, molds, worms, larvae, and other organisms. These organisms simply digest the pollutants remaining in the wastewater.

   Some treatment plants use the activated sludge process. Wastewater is bubbled by aeration to keep the oxygen level high. This allows microorganisms in the bubbling water to reproduce rapidly and decompose the wastes.

6. Any solid material left in the wastewater then settles out in the secondary settling tank. These solids are also sent to the sludge digester. Disposal of the sludge remaining in the digester after bacteria have reduced the size of the solid is a problem. Laws are now being written to help communities deal with sludge disposal.

7. Before the water flows back to the river, it is chlorinated to remove any harmful organisms that might remain.

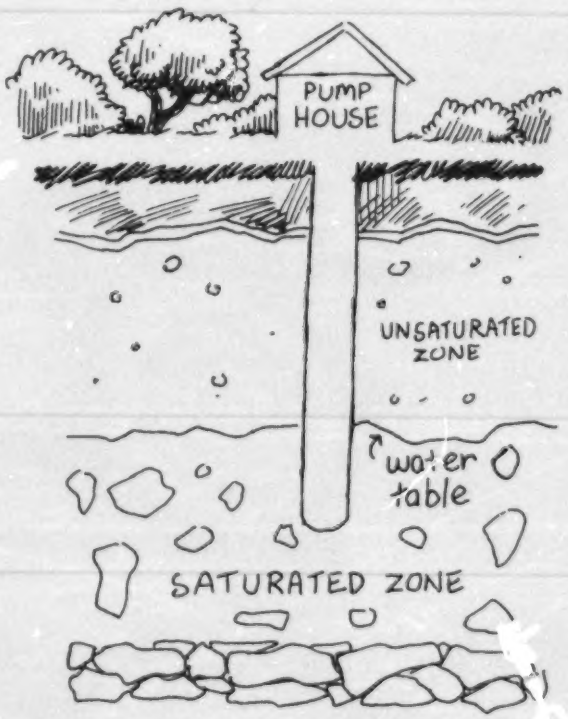
Most, but not all pollutants, are removed from the water. Those that remain may not be directly harmful to humans but can sometimes create problems in rivers and streams. Nitrogen and phosphorus, for example, are two substances found in wastewater that are not entirely removed with secondary treatment. These substances act as fertilizers and can cause too many plants to grow in the water. When the plants die and decay, they reduce the amount of oxygen in the water, and the water may look and smell bad. Since fish and other organisms need oxygen, this condition can cause suffocation and death. Most nitrogen, phosphorus, heavy metals, and substances that cannot be digested by microorganisms can only be removed by a third, expensive phase, called tertiary treatment. This process is needed for very polluted water from big cities and manufacturing plants or when the treated wastewater is sent to streams with high water quality standards.

On-Site Systems

Water Wells

Many communities provide their residents with water from surface sources, like lakes, rivers, and streams, which is treated at filtration plants. Other people have their water supplied from a spring or well on their own property or from city and town wells. Water located below the surface of the ground is called groundwater.

A well is a hole made in the ground to reach groundwater. The supply of water for a well comes from a water-soaked area or saturated zone within the earth's crust. This zone becomes saturated with water because it lies above a layer of rock that cannot be penetrated by water. Another name for the saturated zone is aquifer. The upper level or top of the saturated zone is called the water table. In most aquifers, water must be pumped to the surface, and that takes energy.

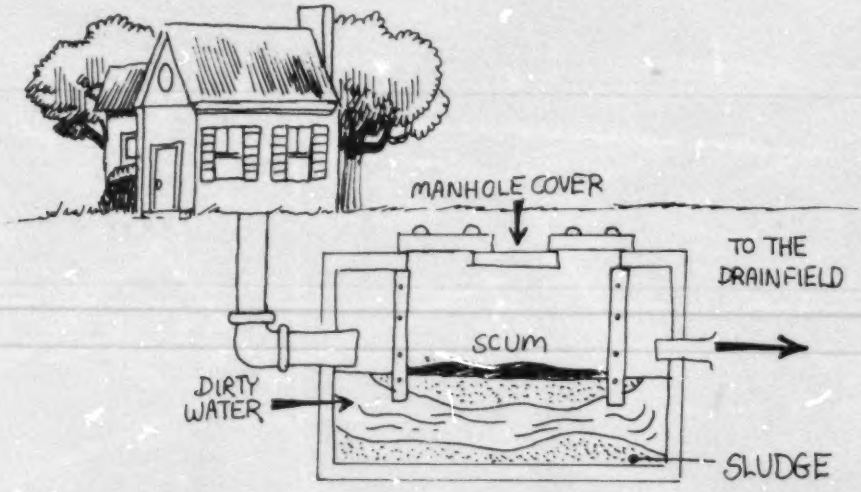


Groundwater is present almost everywhere, but locating an aquifer suitable for a well isn't easy. Plentiful, good-quality water must be found fairly close to the ground surface. When water is being pumped from the aquifer through a well, the water table will be lowered in the area of the well. During dry weather, the water level can be reduced even further and the well can run dry.

Parts of the United States are already running low on groundwater. In areas of Texas and Oklahoma, for example, water is being drawn out of the ground at the rate of 24 inches to 36 inches every year, but rainfall is replacing it at the rate of only 1 inch a year.

Septic Tanks

Over 1/4 of the homes in the United States are not connected to wastewater treatment plants. Most of these 20 million households have their own disposal systems, called septic tanks, which discharge a total of about 800 billion gallons of wastewater into the soil around them each year.



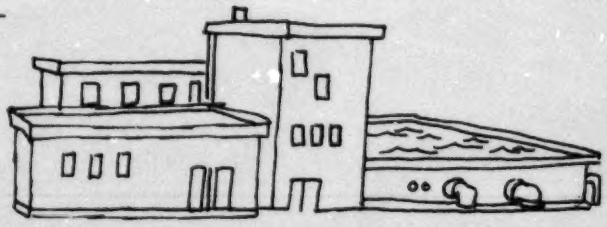
The septic tank system consists of a buried tank in which wastes are collected from the house. Inside the tank, scum (including fat and grease) floats on top, heavy particles sink to the bottom, and the remaining liquid flows through a pipe system to a drainfield in the soil. Aerobic bacteria (bacteria that use oxygen) in the soil digest the solids in the liquid waste while the soil acts as a natural filter. Some anaerobic bacteria (bacteria that do not use oxygen) digest some of the solid sludge, which reduces the amount of solids in the tank. If you flush certain chemicals into the septic tank, you could kill these useful bacteria. The sludge and scum, called septage, are pumped out of the tank every few years. This septage, if it is not treated and disposed of properly, can create health problems and harm the environment. If a septic tank isn't taken care of correctly or if the soil around it isn't suitable for absorbing the liquid waste, a septic system may not work correctly and could pollute ground and surface water.

If we use less water in our homes, less wastewater would be sent to a septic tank or to a wastewater treatment plant. Water that isn't used doesn't have to be treated, so both money and energy are saved.

INVESTIGATION 3

GETTING WATER TO
AND FROM OUR HOMES

Name_____



WATER SUPPLY

A. If the water for your home comes from a town or city well or through a water filtration system complete the following:

1. What is the source of your drinking water?

2. Where is the filtration plant (or well) located?

3. How far is the water filtration plant (or well) from your home?

4. As a class project, find out about how many people are served by the system and how much water is used each day.

   a. Number of people served = _____

   b. Total gallons of water used per day = _____

   c. Now divide the total amount of water used per day by the number of people served. This equals the amount of water used per person per day.

   = _____
   amount of water used per person per day.

5. How much does the city or town charge its residents for water?

Perhaps your parents will show you a recent water bill. From your family's water bill, figure out the average amount of water used each day. Divide by the number of persons in your family. This answer equals the average amount of water used per person per day in your home. Compare your answer to the average used in your city or town.

B. If the water for your home comes from a private well, complete the following:

1. Draw a map of your home and yard on the back of this worksheet or on a separate sheet of paper, and mark the location of the well.

2. How deep is the well? _____

3. Has the well ever run dry?

_____ NO _____ YES When?

4. Has the water ever become unfit or unsafe to drink?

_____ NO _____ YES Why?

5. In the last five years, has the well water been checked to find out if it's safe to drink?

_____ NO _____ YES

6. What is the source of energy for getting water out of the well?

WASTEWATER TREATMENT

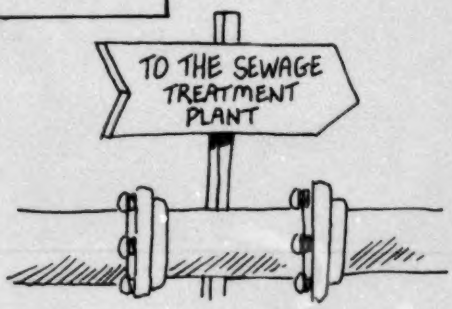
C. If the wastewater from your home flows to a septic tank, complete the following:

1. Draw a map of your home and yard on the back of this worksheet or on a separate sheet of paper, and mark the locations of the septic tank and drainfield.

2. How many gallons of sewage and wastewater does your septic tank hold?

3. Has the septic tank ever worked improperly?

_____ NO _____ YES What was the problem?



D. If the wastewater from your home flows to a treatment plant, complete the following:

1. Where is the treatment plant located?

2. As a class project, discover some facts about your treatment system.

a. What phases of treatment does the wastewater go through?

primary _____ secondary _____ trickling filter _____ or activated sludge _____

tertiary _____

b. About how many gallons of wastewater are treated each day?

c. Where does the treated wastewater go after it leaves the plant?

d. What does your community do with the sludge?

e. How much does the city or town charge its residents for wastewater treatment?

Perhaps your parents will show you a recent sewer bill. In most communities residents are charged a sewer fee based on the amount of water delivered to the home, even though some of the water does not flow to the treatment plant (water used on the lawn, for example).

THE RELATIONSHIP BETWEEN WATER AND ENERGY

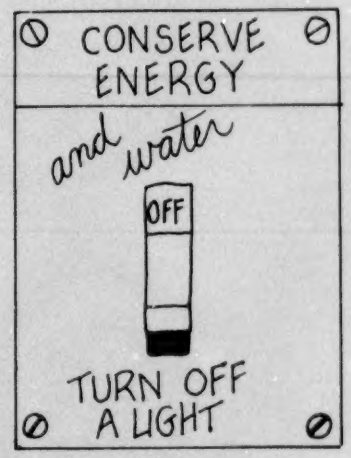
Water and Energy

Being able to get energy in usable forms when it is needed has always been a concern of people. We not only have to think about our energy needs for today, but we must plan for the future. To conserve energy we have been asked to lower the thermostats in our homes in winter and raise them in summer, use mass transit systems or carpools for transportation, and turn off lights when they are not needed.

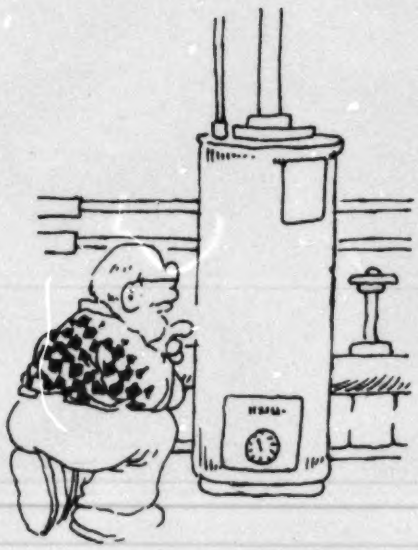
Water is required to make most forms of energy available to us. Coal mining, oil drilling, and hydroelectric and nuclear power production all use large amounts of water. Obtaining and using these energy resources create special environmental problems: erosion, flooding, acid pollution caused by drainage from coal mines, and thermal pollution as water temperature becomes too high for fish and other organisms to live. Disposal of water that has become contaminated by radiation from nuclear power production is a very serious environmental problem.

But do you realize that large amounts of energy are needed to make water available to most of us? Energy is used to clean water at the water filtration plant, to pump water to and from our homes, and to treat wastewater that flows from our homes to the sewage treatment plant. A lot of energy is needed to mine, manufacture, and transport chemicals needed to treat the water. If your family uses a well for water, energy is needed to get the water out from the well into your home. Much energy is required to heat water. In fact, the amount of energy used for heating water is the second largest amount used in most homes. Heating the house uses the most.

As energy needs increase, water pollution and the demands on our limited supply of clean water probably also will increase. Having enough clean water and enough usable energy is important. They are the dynamic duo: the conservation of one is the conservation of the other. If we use less energy, less water will be required in the production process. If we use less water, less energy will be required to treat, distribute, and heat it.



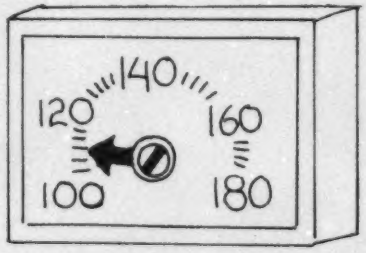
The "Neater" Heater

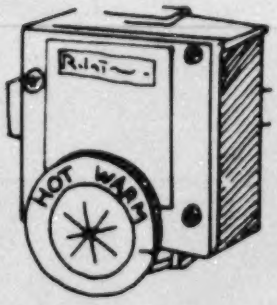


When we conserve hot water, we also conserve energy. Since the water heater is the second largest energy user in a home, consider the following ways to save hot water, energy, and money.

1. The best way to save hot water is to use less by taking shorter showers, washing only full loads in the dishwasher and washing machine, and fixing those hot water leaks fast. A hot water leak, dripping one drop a second for one year, can waste the amount of energy needed to run a color television set for a year or a stereo for five years.

2. The temperature of the water in your home may be hotter than necessary. If the hot water is so hot that it can burn you, the thermostat is probably set too high. With your parents' permission and assistance, find the thermostat of your electric water heater and lower the setting if it is too high. An electric water heater usually has two thermostats that are located behind metal plates on the heater tank.

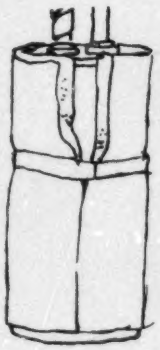




If your family has a gas water heater, the controls are on the outside of the heater and are easy to adjust.

The U.S. Department of Energy recommends a water heater setting of 120° F. For homes with dishwashers, 140° F may be recommended by the dishwasher manufacturers. If your family thinks it can manage with temperatures lower than 120°, try it.

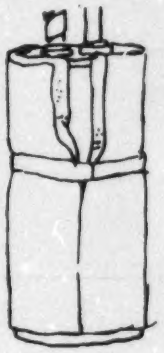
3. Another good way to save money and energy is to add a layer of insulation around the outside of the water heater tank and to insulate the hot water pipes. There are two kinds of insulation available: a) special water-heater and pipe insulation kits, and b) fiberglass insulation used in walls, floors, and ceilings. Proper instructions on the correct way to insulate are provided by the manufacturers of the products. Follow the directions carefully.



4. Turn off the water heater when your family is away from home for a weekend or longer.

5. Consider installing a timer that allows the water to be heated only during times of the day when hot water is needed.

INVESTIGATION 4
THE "NEATER" HEATER



Name_____

1. Where is the water heater located in your home?

2. Is your water heater insulated on the outside?

   _____ YES

   _____ NO Does your family plan to insulate the heater soon? ___ YES ___ NO

3. Are the hot water pipes insulated near the heater?

   _____ YES

   _____ NO Are there plans to insulate the pipes soon? ___ YES ___ NO

4. Is the water heater in your home gas or electric?

   _____ GAS _____ ELECTRIC _____ OTHER

5. How many gallons of water does the water heater hold? _____ gallons.

6. Has your family ever run out of hot water? _____ YES _____ NO

7. With an adult's permission and assistance, check the thermostat setting of your water heater. If you are unable to do so, go to question 8.

   Results of the thermostat check:

   a. When you first checked the thermostat setting, what was the temperature? (If the heater is electric, don't forget to check both thermostats.)

   b. Was the thermostat setting changed?

      _____ NO _____ YES What is the new temperature? _____

8. Describe two ways you can use less hot water in your home.

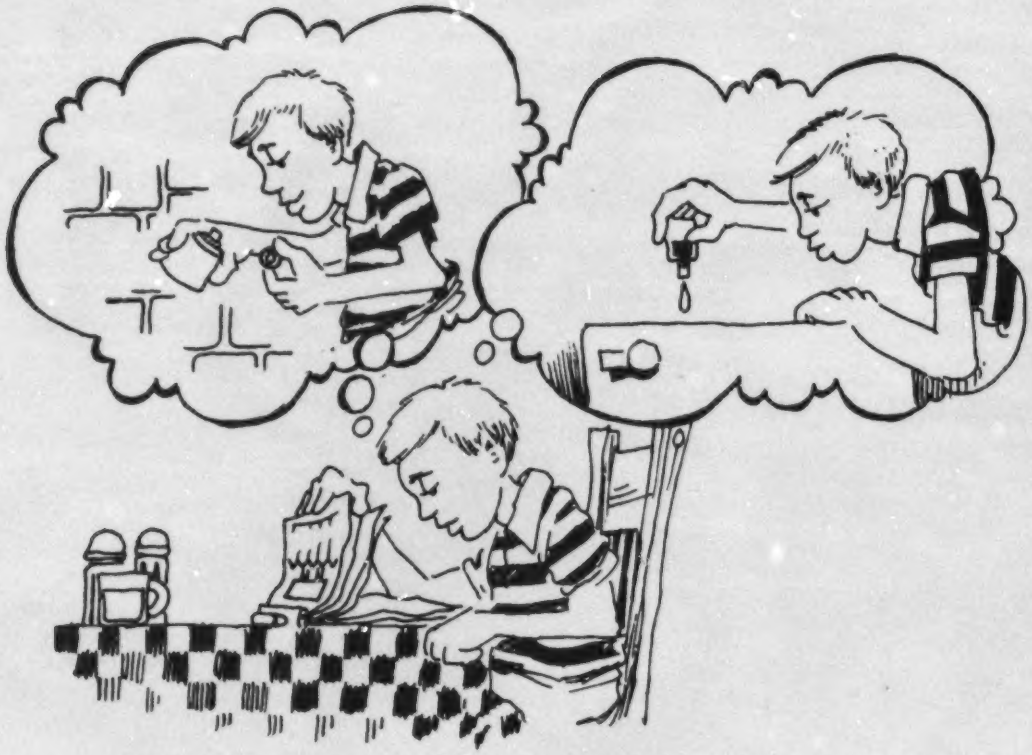
   a.

   b.

WHY CONSERVE WATER?
TO REDUCE THE AMOUNT OF ENERGY NEEDED TO CLEAN, PUMP, DISTRIBUTE, AND HEAT WATER.
TO REDUCE THE AMOUNT OF WASTEWATER THAT FLOWS TO SEWAGE TREATMENT PLANTS AND SEPTIC TANKS.
TO SAVE MONEY ON WATER, SEWER, GAS, AND ELECTRIC BILLS.
TO MAKE OUR CLEAN WATER SUPPLIES LAST LONGER. IT'S TIME TO STOP TAKING WATER FOR GRANTED AND START USING IT MORE EFFICIENTLY.
MAIL

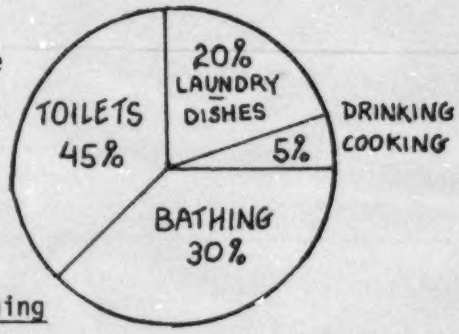
WHEN I WAS YOUR AGE EVERY PERSON USED ABOUT 5 GALLONS OF WATER EACH DAY FOR DRINKING, CLEANING, AND COOKING.
WATER DIDN'T COME AT THE TWIST OF A FAUCET. WE HAD TO PUMP AND CARRY IT. WE USED A WATERLESS TOILET CALLED AN OUTHOUSE.
WE DEPENDED ON RAIN TO WATER OUR LAWNS, GARDENS, AND CROPS

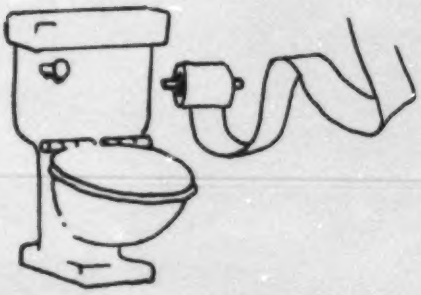
TODAY, EACH PERSON USES ABOUT 80 GALLONS OF WATER A DAY AROUND THE HOUSE. WE USE EVEN MORE WHEN WE WATER THE LAWN AND GARDEN.
5-10 GAL/MIN
6 GAL/MIN
5-7 GAL/FLUSH
12-16 GAL/LOAD
35-60 GAL/LOAD
400-1,100 GAL/MIN
COME ON- LET'S START SAVING WATER RIGHT NOW.



WATER CONSERVATION IN OUR HOMES

This pie graph shows how water is used in the average household. Notice that most of the water, about 3/4 or 75 percent, is used in the bathroom. Let's learn how we can use water more efficiently in this room.

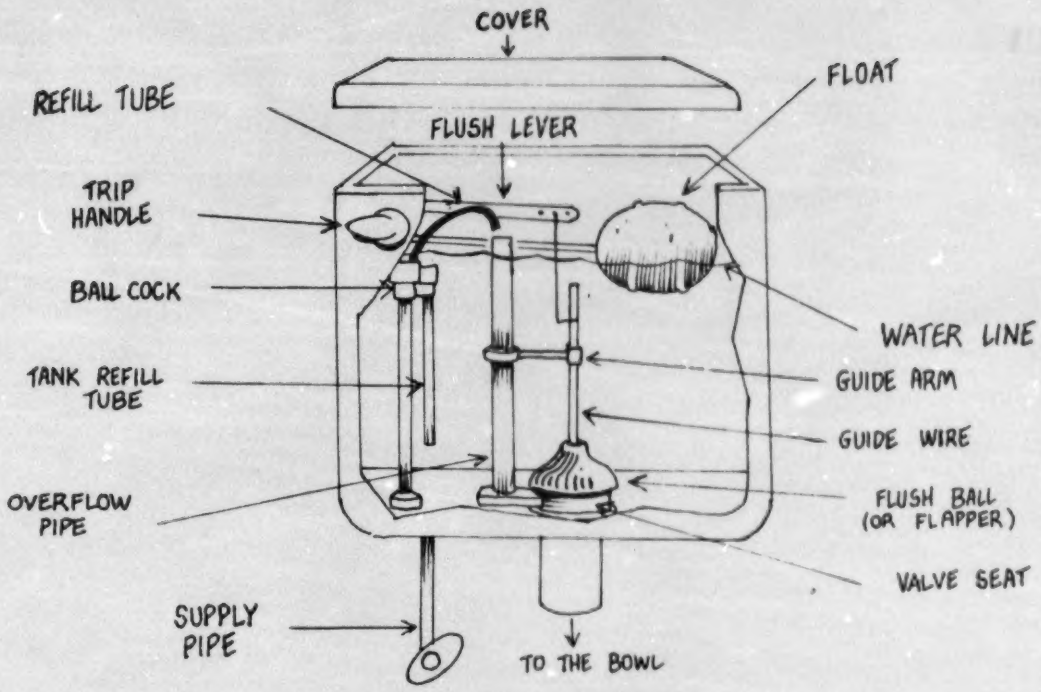




Toilet Training

Toilet . . . water closet . . . commode. They're all names for the unit we use to flush away our body wastes. Almost half of all water used in American homes is used to flush the toilet. There are many ways to reduce this amount.

First, let's see how a toilet operates.



1. Pushing the trip handle raises the flush ball (or flapper), allowing the water from the tank to flow into the toilet bowl.
2. The flush ball remains up until the tank is nearly empty.
3. Then it drops into the valve seat and shuts off the flushing action.
4. As the tank empties, the float drops and opens the ball cock.
5. Water comes from the supply pipe and through the ball cock.
6. As the water flows through the refill tube into the overflow pipe, it refills the toilet bowl.
7. The tank also is filled with water flowing through the ball cock and through the tank refill tube.
8. As the tank is filled, the float rises and closes the ball cock, shutting off the water. It takes about 4 gallons to fill the tank.
9. The guide wire and guide arm help keep the flush ball in place.

The water that fills the toilet tank is clean water from the same pipes that provide water for drinking, cooking, and washing. On the average, more than 4 gallons of water go down the drain every time a toilet is flushed.

Try the following ideas for using water more efficiently in the toilet.

1. Toilet Trouble Shooting

One of the biggest water wasters in the home is a leaky toilet. Have you ever had to jiggle the handle to make a toilet stop making noise? That's a sign of a leaky toilet. Often these leaks aren't noticed because they can't be seen and may not make any noise. Sometimes, though, you can hear a HSSsss sound after the toilet bowl has filled with water. Remember, a leaky toilet can waste over 500 gallons of water a day.

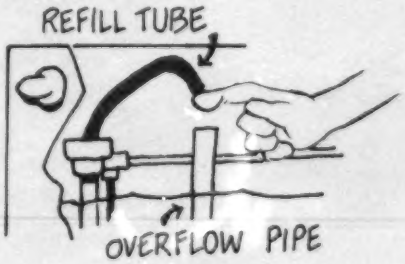
To check for a toilet leak, do the following checks. First, ask your parents or another adult for their permission and help.

Toilet Check A

(1) Make sure there are no wastes in the bowl.
(2) Carefully remove the cover of the toilet tank.
(3) Put some food coloring or special dye pills into the toilet tank to color the water.
(4) Do not flush the toilet for at least 15 minutes.
(5) Then, without flushing, check to see if the color of the water in the bowl has changed. If so, you have a leak to stop.

Toilet Check B

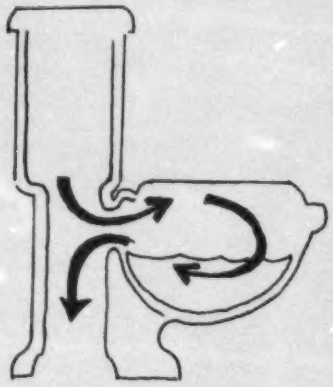
(1) Flush the toilet. To avoid wasting water, wait until there is some waste in the bowl.
(2) Wait about 10 minutes.
(3) Check to see if water is still flowing through the refill tube into the overflow pipe. If so, you have a leak to stop.



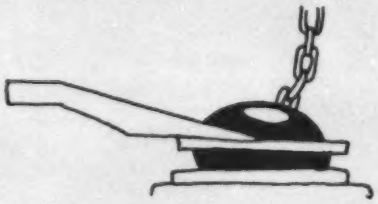
2. Toilet Tune-Ups

If the water in the bowl changed color in Toilet Check A, you can check out these possible problems with your parent's permission and assistance.

a. The water level in the tank should be between 1/2 inch to 1 inch below the top of the overflow pipe. If the water is at or above the top level of the pipe, water will pour into the toilet bowl and go down the drain. To correct this problem, carefully bend the float arm down slightly.



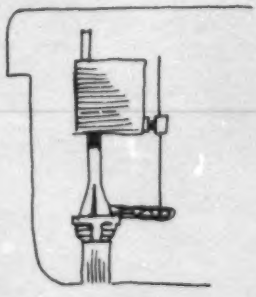
b. Often the flush ball does not fit correctly in the valve seat. Try to line the guide wires up better. The guide wires can also stick or become bent. Sometimes the flush ball wears out or the valve seat becomes corroded. The average life of a flush ball is seven years. A new one costs only a few dollars. New flapper assemblies may be used in the place of flush balls and guide wires. These new assemblies often have chains, so be careful that the chain doesn't get tangled.



Even if the water in the bowl didn't change color in Toilet Check A, the toilet may be leaking. Consider these suggestions:

c. If the water keeps running from the ball cock into the overflow pipe after the bowl has filled up (Toilet Check B), you also have a leak to stop. Sometimes the float leaks. If so, it will not rise enough to shut off the ball cock after the tank refills. Unscrew the float and shake it. If you hear water inside, it should be replaced. The ball cock assembly can wear out, too. You can purchase a new assembly or replace only those parts that are damaged.

d. Your family may be interested in new flushing equipment that eliminates the float and ball cock assembly. This new equipment is usually long-lasting since it is made out of plastic. Some of it is also useful for detecting leaks because it makes a special noise to indicate a leak.

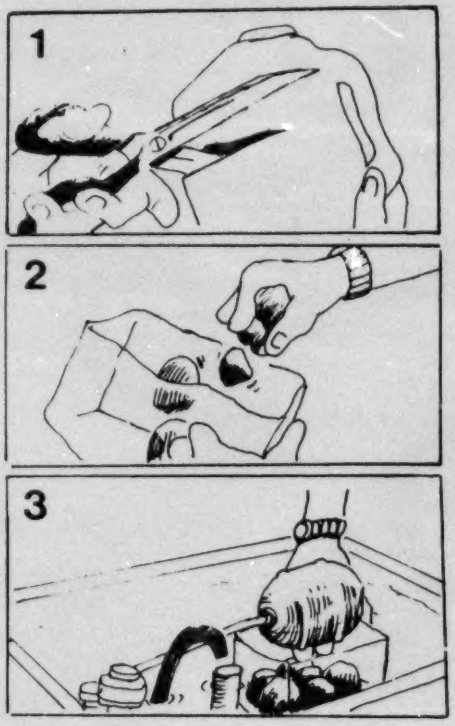


3. Toilet Technology

There are several ways to reduce the amount of water used for each flush.

A Jug in Every Tank

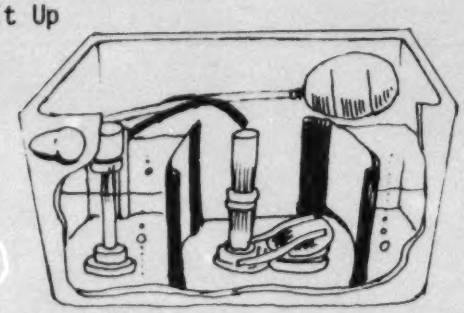
A few years ago, people put bricks in their toilet tanks to save water. The bricks took up some of the space in the tank, but they sometimes crumbled and damaged the toilet fixture and plumbing pipes.



Instead of using a brick, cut the top off a plastic gallon jug. Put some clean, heavy stones in the bottom part of the jug and place it in the tank where it won't get in the way of the moving parts of the toilet. If you use a smaller plastic bottle, you may not need to cut the top off. Just fill the bottle with some water and stones and place it in the tank. Every time the toilet is flushed, you save the amount of water that remains in the jug or bottle.

This method does not reduce the level of the water and therefore does not reduce the force of the water for flushing.

Dam It Up

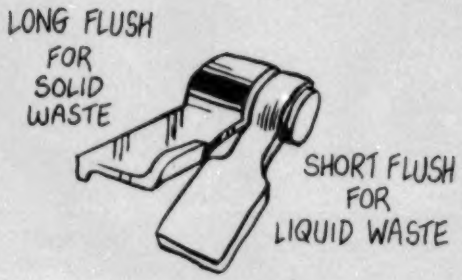


You can buy fairly cheap toilet tank inserts, which can cut the amount of toilet flush water by 1/3 or 1 to 2 gallons. Part of the water in the tank is dammed up and prevented from flowing into the bowl.

Hold That Lever

Simple and cheap weights, such as nuts or solder, can be put on the guide wire or flapper chain. As soon as you let go of the trip lever, the flush ball or flapper will quickly shut off the water flowing into the bowl, before the tank

completely empties. You can hold down the lever as long as necessary for the wastes to be flushed--a short time for liquid wastes and a longer time for solid wastes. You can buy several products that serve the same purpose. Other equipment is available to allow you to select a long flush or a short flush, depending on how you move the trip handle.



WARNING: If you use one of the devices mentioned above and more than one flush is required to flush solid waste from the toilet bowl, remove the water-saving device and try another type. These water-saving devices do not work equally well on all types and brands of toilets.

New Toilet Inventions

Toilets are now being manufactured that use only about 3-1/2 gallons of water per flush. Many cities and states, such as California and North Carolina, require by law that these water-conserving toilets and other water-conserving devices be installed in new homes or where new toilets are installed in remodeling.

Some companies sell toilets that use only a few quarts of water or don't use any water at all, such as composting toilets. Some toilet systems can reuse water from the bathtub or washing machine (called greywater) instead of using clean drinking water to flush away wastes. Some homes have two kinds of water pumped into them: clean drinking water in one pipe and treated greywater for toilet flushing and lawn watering in the second pipe.

4. The Frugal Flush

If it's agreeable to family members, consider flushing less often . . . after 2 or 3 uses, or when there is solid waste. Liquid waste generally is not a health hazard.

Never use the toilet to flush away things like gum wrappers and paper towels.

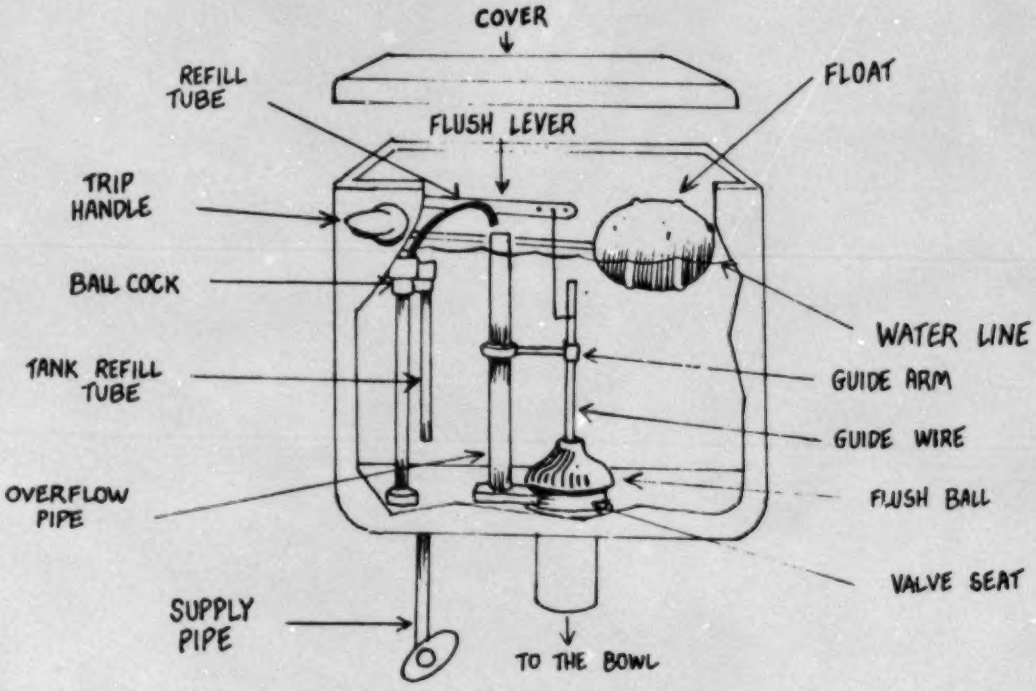
INVESTIGATION 5
TOILET TRAINING

Name_____

1. How many toilets do you have in your home? _____

2. With the lid off the toilet tank, observe how your toilet operates. Check the parts you find in the toilet tank. Remember, some tanks do not contain all of these parts.

   a. ball cock assembly _____
   b. new design float assembly _____
   c. refill tube _____
   d. valve seat _____
   e. guide wire and arm _____
   f. flush ball _____
   g. float _____
   h. flapper and chain _____
   i. water-saving device _____
   j. overflow pipe _____



3. Are there any water-saving devices in your toilet tank(s)?

   _____ NO

   _____ YES What kind of devices? brick____ plastic jug____
   toilet dam____ weight on the guide arm____
   something else____

4. Toilet Leak Checks

Check A

(1) Make sure there are no wastes in the bowl.

(2) Carefully remove the cover of the toilet tank.

(3) Put some food coloring or special dye pills in the tank to color the water.

(4) Do not flush the toilet for at least 15 minutes.

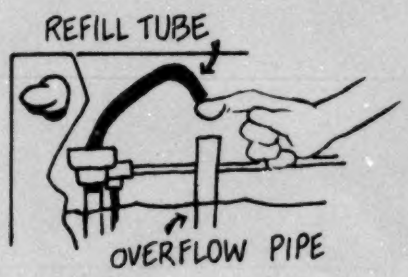
(5) Then, without flushing, check to see if the color of the water in the bowl has changed. If so, you have a leak to stop.

Check B

(1) Flush the toilet. To avoid wasting water, wait until there is some waste in the bowl.

(2) Wait about 10 minutes.

(3) Check to see if water is still flowing through the refill tube into the overflow pipe. If so, you have a leak to stop.



Results of the toilet checks:

In my home, the number of toilets that are leaking is _____. (If you answered 0, you are finished with this investigation).

If you found a leak, what do you think is causing the leak?

If you found a leak, is anyone in your family going to fix the leak(s) soon?

_____ YES _____ NO _____ DON'T KNOW

More Bathroom Basics

The bathroom may be the smallest room in the house, but most of the water used in a home is used in this room. There are many more ways to save water in the bathroom besides the "toilet tips" you've already studied. Since a lot of hot water is used in the bathroom, this is a room in which you can save energy, too. Try these ideas for using water more wisely.

1. Five minutes is enough time for a good shower. A shower without a water-saving shower head uses 5 to 10 gallons of water a minute. (Perhaps you could sing shorter songs.)

2. Try a new device that makes the water flow through a smaller opening. These cheap devices--called flow limiters, restrictors, or controllers--can cut your water use in half. A faucet washer may do the same job and can be installed in the same place as the flow restrictor. You can also buy water-saving shower heads with the restrictor built inside.

3. Turn off the water while you shampoo and soap up. Some shower heads have cut-off buttons so that you can shut off the shower and keep the water temperature the same without turning off the water faucets while you shampoo or soap up. You can also buy a flow cut-off valve and install it on your shower head.

4. Use a kitchen timer to remind yourself and family members when it's time to turn the water off.

5. Don't fill the bathtub too full--1/4 of a tub of water is enough. Every inch of water in the tub is about 4-1/2 gallons, so a half-filled tub uses about 25 gallons of water.

6. When brushing your teeth, don't let the water run the entire time. Every minute, 4 to 5 gallons of water will run down the drain. Use a cup for rinsing.

7. The same rule applies when washing your hair or hands in the sink--shut off the water while soaping up.

INVESTIGATION 6
MORE BATHROOM BASICS

Name_____

1. How many showers are in your home? _____
   (If you don't have a shower, go to question 4)

2. If a shower is used, does it have a flow restrictor or water-saving shower head, or will your family be installing one soon?

   _____ YES _____ NO _____ DON'T KNOW

3. If you generally take a shower, how long do you let the water run?

   Do you think you could take a shorter shower? _____ YES _____NO

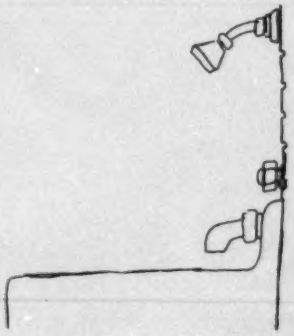
4. How many bathtubs are in your home? _____

5. If you generally take a bath, how deep do you usually fill the tub? _____

   Do you think you could use less water in the tub? _____YES _____NO

   Describe a way you could measure the amount of water, in gallons, that you use for your tub bath.

6. Do the shower-tub activity below, if possible. If your home does not have a shower-tub combination in the bathroom, you will not be able to do this activity.



   Shower-tub activity

   a. Put the stopper in the drain hole of the tub.

   b. Shower as usual.

   c. When you finish showering, check the level of the water in the tub.

   Results of the activity

   Do you use more water for a tub bath or a shower?

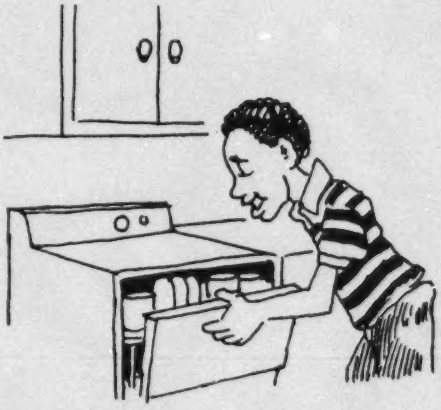
   _____ TUB BATH _____ SHOWER _____ ABOUT THE SAME

All Around the House

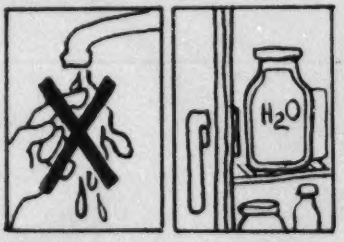
There are many more ways you and your family can save water inside and outside your house. Let's start indoors.

Indoors

1. Wait until you have full loads to wash before operating the dishwasher and washing machine. Unless you have special settings for different size loads, washing one pair of jeans uses the same amount of water, about 35 to 60 gallons, and energy as a full load. Make every cycle count. Remember, these appliances use hot water.

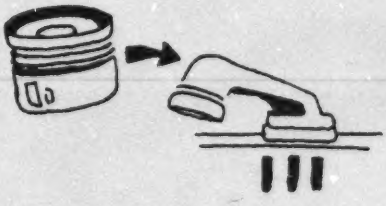


2. If you wash dishes by hand, don't let the water run all the time. Rinse the dishes all at once with running water or use a pan of rinse water. A dishwasher uses about 12 to 16 gallons of water for each load whether it's half-filled or full. Washing dishes by hand requires about 8 to 20 gallons since a kitchen faucet can deliver water at about 5 gallons a minute.

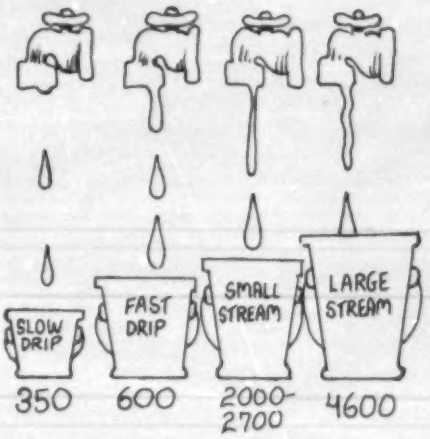


3. Letting the water run to get a cold drink sends a lot of good water down the drain. For cold drinking water, put a bottle of water in the refrigerator. The water may taste better, too.

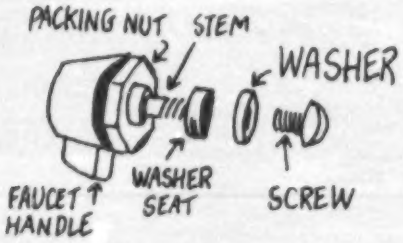
4. A flow-control aerator, attached to the end of each kitchen and bathroom faucet, will save water if it has a built-in restrictor to reduce the flow of water. An aerator can cut the water coming out of the faucet from an average of 5 gallons to 2-1/2 gallons a minute.



5. A leaking faucet wastes more water than you might think. A drip a second could waste over 2,000 gallons a year. Luckily, a dripping faucet is an easy leak to detect. Sometimes a leak can be stopped by turning off the faucet tightly. Don't turn too hard, though, or the washer will wear out more quickly.



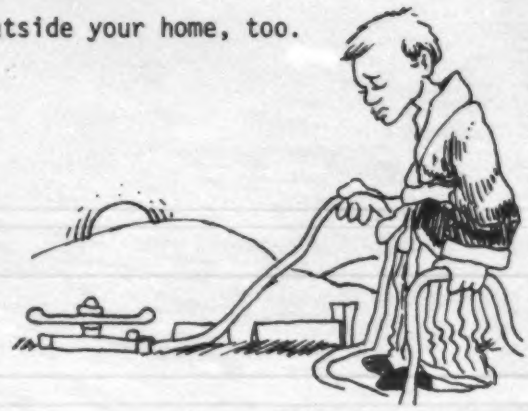
If the dripping continues, the faucet must be repaired. This usually means getting a new washer, which doesn't cost very much and is available at hardware stores. The only tools you may need are a wrench and a screwdriver.



If there is a leaky faucet inside or outside your home, perhaps you can help your parents change the washer. Since there are so many kinds of faucets in use (some do not even use washers), you may want to consult a hardware dealer or plumber or read a home repair book before taking the faucet apart or purchasing a new faucet.

Outdoors

There are many ways to use water wisely outside your home, too.

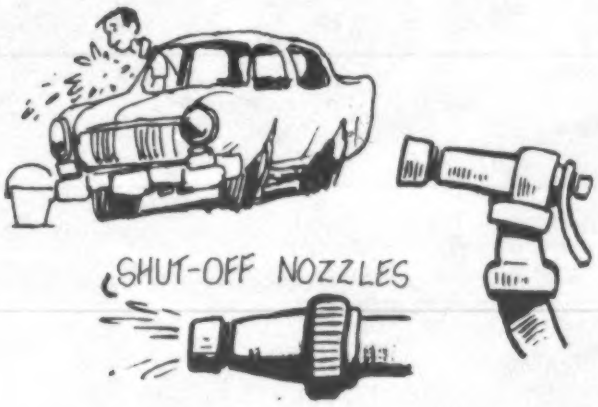


1. A good time to water the grass is in early morning when there's less chance of evaporation. (Late-night watering may encourage grass diseases.) Use sprinklers that spray low, broad drops since spraying fine drops high in the air will just increase evaporation.

2. There's usually no need to water the lawn often. Less frequent, but heavier watering encourages deeper root systems, which can better survive droughts and extreme temperatures. Don't overwater, though, or water sidewalks and driveways, because the water will just run off into the street and sewer.

3. Mulching gardens, shrubs, and trees with material such as sawdust or grass clippings enable the soil to hold moisture longer, so less watering will be needed.

4. A soaker hose is an efficient device to use to water a garden because the water goes directly into the soil.

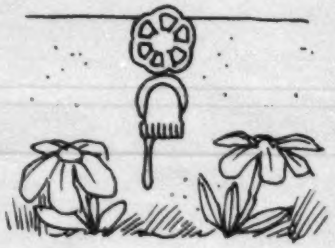


5. If you wash the car at home, a few simple steps will save you many gallons of water.
   a. Rinse the car.
   b. Turn the water off or use a hose with a shut-off nozzle.
   c. Use buckets of soapy water to wash the car.
   d. Give the car a final rinse.

Remember, over 1,000 gallons of water can pass through a 3/4 inch hose in an hour. That's as much water as one person uses in 2 weeks inside the home.

INVESTIGATION 7
ALL AROUND THE HOUSE

Name_____



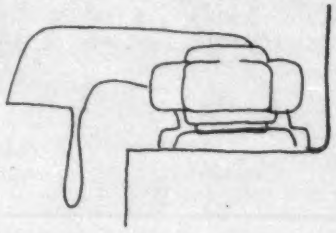
1. How many inside and outside water faucets are at your home?

2. Are any of the faucets leaking?

   _____ NO

   _____ YES How many faucets are leaking? _____

   How many of the leaks could be stopped by shutting off the faucets tightly?



3. If you discovered any leaking faucets inside or outside the house that could not be stopped by tightly shutting off the faucets, is anyone going to fix the leak(s) soon?

   _____ YES _____ NO _____ DIDN'T HAVE ANY LEAKY FAUCETS

6. Is there an aerator on the kitchen faucet?

   _____ YES _____ NO

7. Do you let the water run when you get a cold drink of water?

   _____ YES _____ NO

8. If you wash dishes by hand, do you let the water run all the time?

   _____ YES _____ NO

   If your home has a dishwasher, do you wait for a full load before you use it?

   _____ YES _____ NO

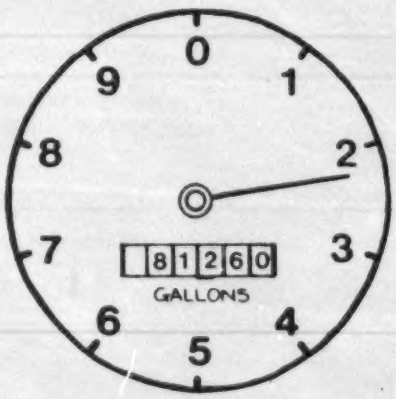
9. On the back of this worksheet, or on a separate sheet of paper, list at least five ways that you and your family regularly practice water conservation.

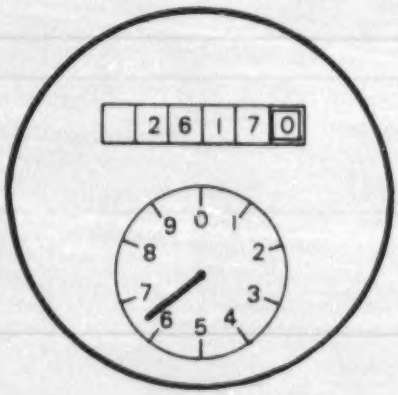
Meet Your Meter

The amount of water coming to your home from a community water supply system can be measured by using a water meter. If your home has a meter, you can use it to help conserve water. Below are some clues to help you check for leaks in your water system and to determine how much water is used in your home.

If the water for your home comes from a well or spring on your property, you will not have a water meter. If you live in an apartment building or a trailer park, your home may not have its own water meter. In either case, you will not be able to complete all of Investigation 8. But it is important to read this section and learn how to read a meter in case your future home has one.

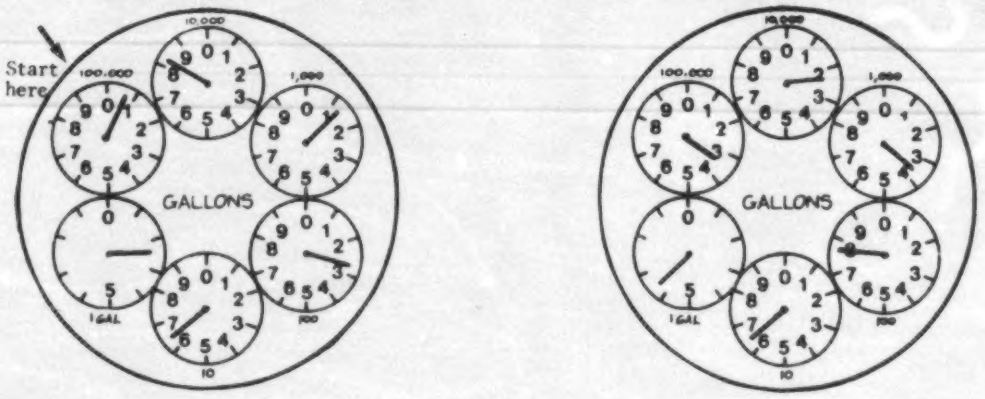
1. There are two basic kinds of meters. The single-dial meter is read like the mileage meter of a car. However, the last digit - "0" - is printed on the meter. The needle on the dial shows you how many more gallons you should add to the number of gallons in the window. The meter pictured on the left shows 81,262 gallons (81,260 + 2 gallons). How many gallons are shown on the second meter?





_____

The six-dial meter is a little more difficult to read than the single-dial meter. You begin by reading the dial labeled with the largest number, usually 100,000. Then read the dials in a clockwise direction. The labeled numbers of each dial will be smaller. Record the numbers indicated by the needles on each dial. If a needle points between two numbers, record the smaller number (except when the needle is between 0 and 9--then record the 9). The meter pictured on the left indicates 81,262 gallons. How many gallons are shown on the second meter?



_____

Some meters measure water in cubic feet instead of gallons, but they are read in the same manner. A cubic foot of water equals about 7.48 gallons of water.

2. Next, find your water meter. Usually the meter is installed in a hole in the ground in the front or back yard near the property line. Look for a metal cover. Sometimes the water meter is installed on an inside or outside wall of a home. Remember that a water meter is town or city property. It's possible your meter lid may be locked or the utility department may discourage citizens from removing the meter cover. Check with a parent or another adult in your home before searching for the meter or removing the cover. Do not damage the meter in any way. Replace the cover as you found it.

3. Once you know where your water meter is located and you know how to read it, you can use it to detect leaks in your home water system.

INVESTIGATION 8
MEET YOUR METER

Name _____

1. Where is the meter located?

2. Water Meter Leak Check

   a. Turn off all the water faucets inside and outside of your house. Make sure no one flushes a toilet or operates a washing machine until you have completed this check. Do not turn off the main water valve.

   b. Read the meter.

      Date _____ Time of Day _____

      Meter Reading _____

   c. Wait at least 1/2 hour—longer if possible. Don't let anyone in your home use any water during this time.

   d. Read the meter again.

      Time of Day _____ Meter Reading _____

   e. If the two meter readings are different, your home has a water leak. The leak may be inside your home or in a pipe underground between the meter and the house.

      Result of the experiment:

      Is there a leak in the water system of your home?

      _____ YES _____ NO

      Some meters have a little button that looks like this ✳ or this ▲ that spins when water is being used. This button could help detect leaks.

   f. If you discover your home has a water leak, it may be underground between the meter and the building. To detect this kind of leak, with an adult's assistance, first, turn off the main water valve to your home. Then, if the meter dial still moves, the leak is probably between the meter and your home. Call your water department or a plumber for advice.

REPLACE THE COVER ON THE WATER METER AS SOON AS YOU COMPLETE THIS CHECK

3. Does the meter for your home measure water in gallons or cubic feet?

_____ GALLONS _____ CUBIC FEET

4. Does your home have a single-dial (speedometer-type) meter or a six-dial meter?

_____ SINGLE-DIAL _____ SIX-DIAL

5. You can use the water meter to figure out how much water is used for different activities around the house.

Water Use Check

a. Wait for a member of the family to use the shower.

b. Watch the meter dial move for exactly one minute and record the amount of water used.

c. Time how long the shower takes.

d. Multiply the amount of water used in one minute by the number of minutes the shower takes.

Amount of water used in 1 minute	X	Number of minutes the shower takes	=	Total amount of water used during that shower
_____		_____		_____ gallons

e. Do the same experiment for watering the lawn.

f. How could you use the water meter to measure how much water is used to flush a toilet, wash a load of clothes, or take a bath?

Use this method to answer the following questions:

(1) One toilet flush requires _____ gallons of water.

(2) Washing one load of clothes requires _____ gallons of water.

(3) Washing one load of dishes requires _____ gallons of water.

(4) One average bath requires _____ gallons of water.

REPLACE THE COVER ON THE WATER METER AS SOON AS YOU COMPLETE THIS CHECK

INVESTIGATION 9
WATER IN THE NEWS

Name _____

1. Check your local newspaper for one week and write down titles or clip out articles that concern water.

   Monday
   Titles:

   Tuesday
   Titles:

   Wednesday
   Titles:

   Thursday
   Titles:

   Friday
   Titles:

   Saturday
   Titles:

   Sunday
   Titles:

2. Were any of the articles about conserving water?

   _____ YES _____ NO

3. On the back of this worksheet or on a separate sheet of paper, summarize one of the articles.